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ORIGINAL ARTICLE

PHYSICAL FUNCTIONAL EVALUATION ON MORTALITY IN CHRONIC RENAL PATIENTS

AVALIAÇÃO FÍSICA FUNCIONAL NA MORTALIDADE EM DOENTES RENAIS CRÔNICOS

EVALUACIÓN FÍSICA FUNCIONAL ACERCA DE LA MORTALIDAD EN PACIENTES RENALES CRÓNICOS

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ABSTRACT

Objective: verifying the evaluation of functional physico association and mortality of patients with Chronic Kidney Disease. ***Method:*** a cross-sectional study conducted with 25 patients with CKD on hemodialysis (HD), 17 living participants G1 (56,29±7,76 years old) and eight who died, participants G2 (58,63 ± 17,13 years old). Data collection was performed by physical tests and after a year it was observed mortality and data analyzed in PASW Statistics Data Editor Software. The project was approved by the Research Ethics Committee, Opinion n 187.1/2011. ***Results:*** there was the incidence of 32% of deaths. No statistically significant differences were found between the living and deaths within a year after the physical functional evaluation in VO_{2pico} (p: 0,156), in the TC6min (p: 0,298), the PI_{max} (p: 0,062) and PE_{max} (p: 0,232). ***Conclusion:*** no association was found between physical functional assessment and mortality of patients with CKD. ***Descriptors:*** Renal Insufficiency; Health Evaluation; Mortality.

RESUMO

Objetivo: verificar a associação avaliação físico funcional e a mortalidade de pacientes com Doença Renal Crônica. ***Método*****:** estudo transversal realizado em 25 indivíduos com DRC em hemodiálise (HD), sendo 17 participantes vivos do G1 (56,29±7,76 anos) e oito que foram a óbito, participantes do G2 (58,63±17,13 anos). A coleta de dados foi realizada pelos testes físicos e após um ano foi verificado a mortalidade e os dados analisados no software PASW Statistics Data Editor. O projeto foi aprovado no Comitê de Ética em Pesquisa, parecer n 187.1/2011. ***Resultados:*** observou-se a incidência de 32% de óbitos. Não foram encontradas diferenças estatisticamente significativas entre vivos e óbitos no intervalo de um ano após a avaliação físico funcional no VO_{2pico} (p:0,156), no TC6min (p:0,298), na PI_{max} (p:0,062) e na PE_{max} (p:0,232). ***Conclusão*****:** não foi encontrada associação entre a avaliação físico funcional e a mortalidade de pacientes com DRC. ***Descritores:*** Insuficiência Renal; Avaliação em Saúde; Mortalidade.

RESUMEN

Objetivo: verificar la asociación evaluación físico funcional y la mortalidad de los pacientes con Enfermedad Renal Crónica. ***Método:*** un estudio transversal en el que 25 pacientes con ERC en hemodiálisis (HD), siendo 17 participantes vivos del G1 (56,29 ± 7,76 años) y ocho que murieron, los participantes del G2 (58,63±17,13 años). La recolección de datos se realizó mediante pruebas físicas y después de un año se observó la mortalidad y los datos analizados con el software PASW Statistics Data Editor. El proyecto fue aprobado por el Comité de Ética en la Investigación de Opinión n 187.1/2011. ***Resultados:*** se observó la incidencia de 32% de las muertes. No se encontraron diferencias estadísticamente significativas entre vivos y la muerte dentro de un año después de la evaluación física funcional en VO_{2pico} (p: 0,156), en la TC6min (p: 0,298), el PI_{max} (p: 0,062) y PE_{max} (p: 0,232). ***Conclusión:*** no se encontró asociación entre la evaluación física funcional y la mortalidad de los pacientes con ERC. ***Descriptores:*** Insuficiencia Renal; Evaluación de la Salud; Mortalidad.

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INTRODUCTION

Mortality for patients with Chronic Kidney Disease (CKD) is high and tends to increase.[1] Scientific publications point to the influence of various factors that may be related to increased mortality of CKD. May be involved traditional risk factors and those related to CKD and the dialysis process, such as anemia, chronic inflammation, malnutrition, left ventricular hypertrophy, calcium and phosphorus product lifting and urea removal rate (Kt/V) down.[2] Study[3] shows independent risk factors for mortality and non-cardiovascular causes cardiovascular cause for the age or equal to 60 years old and the highest hemoglobin 9 g/dl, and death from cardiovascular disease only blood glucose greater than or equal to 126 mg/dl and cardiovascular disease mortality not the Kt/V less than 1,2.

Study[4] shows the influence of ethnic factors on mortality, where South Asians have better survival than whites, possibly the best nutritional conditions, ideal body mass index and genetic factors. Another study[5] identifies that the patients do not waiting for transplants have evolved more often to die within 12 months and had associated pathological occurrence, the most common being the diabetes mellitus and hypertension, advanced age and low quality of life.

Regarding mortality in CKD[6] another study describes about the planned choice of renal replacement therapy. Peritoneal dialysis when compared with hemodialysis was associated with higher mortality among the elderly, especially among those with diabetes, even after having controlled a large number of risk factors for mortality.

Patients with CKD have a functional impairment in physical performance among them the decrease in distance walked in six minutes test (6MWT), decrease in vital capacity and inspiratory and expiratory muscle strength compared to the predicted values in adult individuals[7] and also described in adolescents [8]. The reduction of functional capacity in CKD patients on hemodialysis can harm the development of basic activities, and leisure, work and social life, deteriorating quality of life.[9] However, values of physical performance are hardly known for its association with mortality in patients with CKD, so this study aims to:

- Checking the functional physic association and mortality of patients with Chronic Kidney Disease.

METHOD

Article compiled from the institutional research project << **Profile of cardiovascular risk factors, physical fitness and quality of life of chronic renal failure patients undergoing and not undergoing hemodialysis** >> presented in the monograph of defense called "Association of mortality of chronic disease ill patients with functional physical profile" at the Department of Physiotherapy, Department of Life-Sciences DCVida of the Regional University of the Northwest of the State of Rio Grande do Sul - UNIJUÍ, Ijuí (RS), Brazil. 2013.

This is a cross sectional descriptive study that is part of the "Profile of cardiovascular risk factors, physical fitness and quality of life of chronic kidney patients undergoing and not undergoing hemodialysis" and approved by the Ethics Committee of the Regional University of the Northwest of the State of Rio Grande do Sul, on the advice embodied No. 187.1/2011, protocol 0057/2011.

The study included people with CKD who were undergoing hemodialysis two to three days a week, lasting three to four hours a session, both sexes, clinically stable with medical authorization of presentation, allowing the performance of physical tests. The study subjects were excluded unable to understand and perform the test procedures, those who did not sign the consent form and clarified who have not completed the assessment protocol or contact impossibility. A year after the completion of physical tests was entered into telephone contact to see if they were alive or died.

♦ Procedures and instruments

The profile of individuals was collected from the interview and direct assessment with the patient. Data were collected regarding the cardiovascular risk factors, laboratory tests, anthropometric measurements, strength and respiratory muscle strength, maximal and submaximal functional capacity, lower limb strength and quality of life. The evaluation period of collection was from July to December 2011.

When starting the study, the selected individuals were submitted to an assessment protocol, as described below.

Identification and patient risk factors: there were collected from interviews with the patient personal data such as name, phone number, and home address, and occupation, date of birth, age, gender, and weekly frequency of hemodialysis session length. There were also investigated the cause of

chronic kidney disease, risk factors for cardiovascular diseases and registered laboratory exams.

Anthropometric measurements. The weight was checked (kg), height (cm) and body mass index (BMI = weight/height^2). The waist circumference (WC: cm) was assessed by standard tape measure and measured the height of the umbilicus, with the patient standing and with arms relaxed at your sides. Hip circumference (HC: cm) measured by standard tape measure and measured in the largest point of the hip, with the patient standing and with arms relaxed along the body.[10]

♦ Respiratory muscle strength (RMS):

RMS was determined by measurement of maximal inspiratory pressure ($\mathbf{PI_{max}}$) and maximal expiratory pressure ($\mathbf{PE_{max}}$), using the digital manometer MVD-300 (Microhard System, Globalmed, Porto Alegre, Brazil). During the procedure, subjects remained seated at rest, with straight trunk and nostrils occluded with a nose clip to prevent air leakage. The $\mathbf{PI_{max}}$ was obtained after the patient inspiring the residual volume to total lung capacity generating a maximal inspiratory effort, and this time the patient occluded the hole in the nozzle. While $\mathbf{PE_{max}}$ was measured after the patient expiring total lung capacity to residual volume, with consequent maximum expiratory effort, and the occluded nozzle orifice in the same way that occurred in measuring the $\mathbf{PI_{max.}}$[11] Were recorded the highest values of $\mathbf{PI_{max}}$ and $\mathbf{PE_{max}}$ expressed in cmH2O, which is not greater than 10% of the second highest value. There was considered with decreased inspiratory muscle strength in subjects who had manometer $\mathbf{PI_{max}}$ less than or equal to 70% of its expected, according to gender and age.

♦ Muscular endurance of the lower limbs

It was evaluated by the test chair stand a minute (TSL1min), where the subject was instructed to sit in a chair with his back resting on the back of it, and soon after getting up without support arms extending knees and following sit again playing his back on the chair. One should realize maximum possible increases in a minute.

♦ Walk test in six minutes (6MWT)

The submaximal functional capacity was measured by the walking test in six minutes (6MWT), it is a simple test and able to safely measure the functional capacity and is well accepted by patients. It has been reproduced according to the American Thoracic Society.[12] The participant was instructed to walk for six minutes as soon as possible, being encouraged by verbal commands every minute. It was allowed him to establish the walking step and made when necessary interruptions. The meters covered and assessed were recorded before the test and after, BP, respiratory rate (RR), perceived exertion (Borg graduated scale 0-10), FC and peripheral oxygen saturation (SpO_2), obtained by pulse oximeter (Nonin Onyx 9500). To estimate the ideal distance to be traveled, we used the distance traveled prediction formulas, according to the gender[13]. The interruption criteria were: SpO_2 <87%, dizziness, headache, nausea, significant angina, severe dyspnea, fatigue and considerable cramps.

♦ Cardiopulmonary exercise testing

The maximum incremental exercise test was performed on a treadmill (Imbrasport Porto Alegre, Brazil), with ramp protocol (initial speed of 1km/h end of 6km/h; initial inclination of 0% and after 10% hike in time 10 minutes) and the exhaled gases were analyzed every 20 seconds through a gas analyzer (Total Metabolic Analysis System, TEEM 100, Aero Sport, Ann Arbor, Michigan). Blood pressure was measured every 3 minutes with a sphygmomanometer. The HR was determined using the RR interval from 12-lead electrocardiogram. Among the variables of cardiopulmonary exercise test were included VO_2peak, defined as the highest value achieved during the test; circulatory peak power, calculated as the product of peak VO2 and systolic pressure peak[14] and the kinetics of recovery oxygen consumption, measured as the time required for 50% decrease from the VO_2peak ($T_{1/2}VO_2$), calculated using the model mathematician minimum square.

♦ Statistical analysis

Data were processed in the statistical package SPSS Statistics Data Editor (version 18.0, Chicago, IL, USA). The descriptive analysis is presented as average ± standard deviation, relative and absolute frequency. For quantitative variables held the Shapiro-Wilk normality test, and, for non-parametric U test (Mann Whitney), to compare the means. The qualitative variables, we used Fisher's exact. $P \leq 0,05$ was considered significant.

RESULTS

The sample consisted of 25 people with CKD on dialysis in the city of Ijuí, Northwest Region of Rio Grande do Sul State - Brazil. Functional physical evaluation was performed after one year and this has been verified the mortality of these patients. Of the 25 patients, 17 (68%) remain alive and 8 (32%) died within one year after evaluation. For

data analysis, these patients were divided into two groups: G1 (CKD patients on HD, which remained alive) and G2 (CKD patients who were in HD and died within one year after evaluation).

No statistically significant differences between the variables analyzed were found. The characteristics as age and gender were similar in both groups. The same behavior was observed in the anthropometric variables (weight, height, BMI, WC and HC). Of those who died the majority (62,5%) had a BMI within the normal range, different from those living where most were overweight (76,5%).

Among patients who died, a higher incidence of mortality in males was observed (87,5%) and shorter hemodialysis, although not statistically significant. By analyzing the cardiovascular risk factors (CRF), it was found that sedentary lifestyle has been prevalent in the group that died (100%), followed by hypertension (87,5%). Clinical characteristics and baseline are shown in Table 1.

Table 1. Clinical characteristics and baseline levels of patients with CKD on dialysis live (G1) compared to those who were the deaths within a year after evaluation (G2).

	G1 (n=17) Alive	G2(n=8) Deaths	Average or Total	p
Age (years)	56,29±7,76	58,63±17,13	57,04±11,27	0,294£
Gender (male/female)	9/8	7/1	16/9	0,095†
Weight (Kg)	72,62±11,98	70,00±12,36	71,78±11,91	0,322£
Height (cm)	161,53±5,89	166,75±8,38	163,20±7,05	0,129£
BMI ($kg.m^{-2}$)	27,79±4,43	25,26±3,64	26,98±4,29	0,129£
Classification of BMI n (%)				0,069†
Low weight	0(0)	0 (0)	0 (0)	-
Normal	4 (23,5)	5 (62,5)	9 (36,0)	-
Over weight	7 (41,2)	2 (25,0)	9 (36,0)	-
Obese level I	5 (29,4)	1 (12,5)	6 (24,0)	-
Obese level II	1 (5,9)	0 (0)	1 (4,0)	-
CA (cm)	99,09±10,72	95,38±11,19	97,85±10,78	0,461£
CQ (cm)	98,25±7,58	97,75±7,97	98,08±7,54	0,830£
RC/Q	1,00±0,72	0,97±0,07	0,99±0,71	0,270£
Origin of CKD				0,067†
Diabetic and Hypertensive	0(0)	1(12,5)	1(4,0)	-
Hypertensive	1(5,9)	1(12,5)	2(8,0)	-
Nephrosclerosis	4(23,5)	0(0)	4(16,0)	-
Chronic Glomerulonephritis	1(5,9)	1(12,5)	2(8,0)	-
Diabetic	1(5,9)	0(0)	1(4,0)	-
Other	3(17,7)	4(50)	7(28)	-
Non-informed	7(41,1)	1(12,5)	8(32,0)	
Time of hemodialysis (months)	38,93±24,3	35,50±28,28	37,74±25,16	0,771£
Frequency of hemodialysis (days)	2,90±0,316	2,86±0,378	2,88±0,33	0,793£
Duration of the session of hemodialysis (hours)	2,38±0,52	2,00±0,82	2,20±0,68	0,336£
FRCv n (%)				
Sedentary	15 (88,2)	8 (100)	23 (92,0)	0,453†
DM	5 (29,4)	3(37,5)	8 (32,0)	0,513†
Smoking	1 (5,9)	0 (0)	1 (4,0)	0,001†
Social alcohol use	3(17,6)	3 (37,5)	6 (24,0)	0,186†
Hypertension	15 (88,2)	7(87,5)	22 (88,0)	0,473†
Hemoglobin (g/dL)	10,04±1,52	9,36±1,77	9,76±1,61	0,222£
Hematocrit (%)	31,20±4,94	29,00±5,35	30,29±5,07	0,221£

G1 = CKD patients undergoing dialysis who are alive; G2 = Patients with CKD who were died after a year of assessment. SAH = systemic arterial hypertension; DM = Diabetes Mellitus; FRCv: cardiovascular risk factors; CA: waist circumference; CQ: hip circumference; RC/q: relationship waist hip; BMI: body mass index; HD: hemodialysis; †: Fischer exact test; £: Mann Whitney U-Test; *: $p \leq 0,05$, statistically significant.

The group that died had a decrease in muscle and expiratory strength (≤70% predicted), while the survivors only had a decrease in muscle strength.

There were no statistically significant differences in functional capacity between the survivor group and the group died. However, it is observed that the latter had a greater decrease in functional capacity observed at the lowest test performance of muscular endurance, TC6min and VO_{2max}, as described in Table 2.

Table 2. Respiratory muscle strength, functional capacity, maximum functional capacity and submaximal muscular endurance in the lower limbs of the G1 and G2.

	G1 Alive	G2 Deaths	Total	p
$PI_{máx}$ (cmH_2O)	85,53±40,57	52,13±26,51	74,84±39,44	0,062£
$PI_{máx}$ % do prev.	51,25±64,79	13,13±35,89	39,05±59,19	0,062£
$PE_{máx}$ (cmH_2O)	90,18±47,61	64,00±35,76	81,80±45,16	0,232£
$PE_{máx}$ % do prev.	89,99±45,93	58,10±34,12	79,79±44,46	0,071£
TC6min – dist. (m)	453,06±82,60	403,63±147,76	436,58±107,98	0,298£
TC6min % do prev.	87,32±14,58	74,74±22,98	83,13±18,33	0,232£
VO_{2pico} (ml/Kg/min.)	18,10±4,27	15,18±7,87	17,13±5,7	0,156£
SL (nº elevadas)	20,64±6,40	18,75±7,36	19,95±6,66	0,273£

PI_{max} = maximum inspiratory pressure; PE_{max} = maximal expiratory pressure; TC6min =6-minute walk test; VO_{2pico}= peak oxygen consumption; SL: test seat and lift; £: Test U – Mann Whitney; *: p≤0,05, statistically significant.

DISCUSSION

The results show that, although not statistically significant between the groups (survivors x death), patients who died (32%) have a lower functional capacity compared to those who have not died (68%). This may be an indication that the physical condition of the patient can be seen in the survival condition, although this is not an aspect that will be the determinant of his death, but that may be a risk factor associated with mortality of these patients.

It was observed that the BMI of the patients who died, 62,5% were within the normal range, unlike that are alive, where 76,5% had BMI in the overweight range. Study[8] found 20% of their sample of adolescents with CKD underweight. A prospective cohort study[15] conducted with five hundred forty-one hemodialysis patients assessed the impact of excess weight in atherosclerotic events and found that similar to the general population being overweight contributes to an increased risk of cardiovascular events and mortality. Study[16] noted that there is an increased risk of death for patients with a BMI ≤ 20 kg/m^2, both for patients and for those on hemodialysis, peritoneal dialysis only. As the body size was increasing, the relative risk (RR) of death decreased in such a way that patients with BMI > 30,0 kg/m^2 experienced a greater benefit in the RR for death. This survival benefit has been attributed, at least in part, to a greater reserve power between the large patients.

In both the sedentary group was the predominant CVRF, showing that most of these individuals do not follow a program of physical activity as part of their kidney treatment. It is noteworthy that the group died sedentary showed 100% prevalence. Patients with chronic kidney disease undergoing dialysis have physical and psychological changes that predispose to a sedentary lifestyle and that routine prescription is not a common clinical practice, though, the literature describes higher risk of death in sedentary[17] and on the other hand the association frequent exercise with improved survival.[18]

Study[17] evaluated two groups of chronic renal failure patients on dialysis within one year and concluded that sedentary patients had risk of death by 62% higher when compared to non-sedentary. In agreement with these findings demonstrated in another study[18], patients on dialysis to performing physical exercise two to three times per week or four or five times per week reduced the risk of death, respectively 29 and 33% when compared to sedentary individuals. After inactivity, hypertension was high prevalence of risk factors for both groups, which is also found in other studies with CKD.[19]

In assessing the distance covered in the TC6min compared between groups, there was no significant difference between them; however, it is observed that the group of deaths showed a lower functional capacity. Individuals who died in the TC6min showed a lower yield on average 50 meters a VO_{2max} of 16,1% (ie 3ml O_2/kg/min) and lowest in TSL1min for muscular endurance of the lower limbs, had a yield of 9,1% lower when compared to the survivor group. This is a relevant fact worth mentioning, but the limitation of this study is the small sample size.

The functional physical impairment is also demonstrated in recent studies in patients with CKD.[7,8] Study[8]conducted a study in adolescents with CKD and conservative treatment, average age of 11,13 ± 3,35 years old, showing that the performance TC6min was significantly lower compared to the control group without renal impairment, confirming the worsening of the functional capacity of these patients. Another study[7] conducted with 27 individuals young and old adults, found that 24 CKD patients also had significant reduction in distance traveled relative to the predicted value. Even this study presenting different sample profile,

consisting of 25 young adults and older adults with CKD undergoing renal replacement therapy (RRT), we observed that the group that died had significantly reduced distance traveled relative to the predicted value, which agrees with the data described in the literature.

Using the VO_{2pico} for the assessment of functional capacity, study[20] found that patients with hemodialysis have an average value of 64% of the average healthy individuals, sedentary and of the same age. Another study[21]showed that the mortality rate in these patients increases when the VO_{2pico} reaches values less than 17,5 ml O_2/Kg/min. In the present study VO_{2pico} the group died was lower, ie 15,18 ml O_2/Kg/min when compared to individuals who were alive after one year of functional physical assessment.

In addition to the reduction of the distance walked in the 6MWT, there was identified a decrease in respiratory muscle strength in patients with CKD studied. The group that died had a decrease in muscle strength and expiratory (≤70% predicted), while the survivors only had a decrease in muscle strength. Other studies 7.22 with individuals with CKD also show that respiratory muscle strength and pulmonary function variables are below the normal range. Other studies[23,24] confirmed a decreased from 30% to 40% of muscular strength when compared with normal subjects. The decrease in expiratory muscle strength of patients with CKD was more evident in individuals who died, may be related to physical inactivity and respiratory mechanics, and because inspiration is an active process and the passive expiration, the expiratory muscles may be weaker from disuse[25]. However, what sets this work of others, renal disease is the analysis of functional physical evaluation results conducted a year before some patients go to death allowing analysis between the living and that died.

This study also showed decreased peripheral muscle strength measured by the test sitting and standing in DRC and although not significant, the group of patients who died had fewer high in the test. Importantly, the reduction in respiratory muscle strength can lead to peripheral muscle weakness. Potential mechanisms by which CKD may negatively impact the skeletal muscle are multifaceted and complex, due to muscle perfusion changes, the substrate delivery, and catabolic state mediated by several factors, such as metabolic acidosis, corticosteroids, proinflammatory cytokines and decreased physical activity, among other.[26]

The findings in this study indicate that patients with CKD may show decreased functional performance. Also another study [27] evaluated the worsening of general health (16,9%) compared to a year ago. Therefore, the present study provides data suggesting the need of further work on this subject with the highest number of patients with longer follow-up which may help professionals in clinical treatment, in their speeches and in understanding the evaluation of the influence functional physical mortality of patients with CKD.

The limitation of this study was the small sample size and short follow-up interval (one year) in the analysis of mortality and its relationship with the functional aspect of the physical assessment, but shows that the physical condition should be valued within the clinical evaluation and further investigated. Therefore, this paper contributes to the discussion of this aspect in patients with chronic kidney disease and carrying out larger-scale studies.

CONCLUSION

Of the 25 patients assisted 32% died within a period of one year. It was found that no association was found between functional and physic mortality in patients with CKD.

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